CLAIMS

What is claimed is:

1. In an implantable cardiac stimulation device having an atrial bipolar lead and at least one ventricular lead, a method for determining an atrial rate comprising:

tracking refractory periods within both the atrial and ventricular channel signals; and

determining an atrial rate using bipolar sensing outside the refractory periods and using combined unipolar/bipolar sensing within the refractory periods.

2. The method of claim 1 wherein determining the atrial rate using bipolar sensing outside the refractory periods and using combined unipolar/bipolar sensing within the refractory periods is only performed if automatic mode switching (AMS) is enabled in the implantable stimulation device or if an atrial high rate detection diagnostic event counter is enabled, otherwise the atrial rate is determined based only on events outside the refractory periods sensed via bipolar sensing.

3. The method of claim 1 further comprising increasing a ventricular sensitivity during the refractory periods to at least equal that of an atrial sensitivity.

4. The method of claim 3 wherein updating the atrial rate based on events detected inside the refractory periods using combined unipolar/bipolar sensing employs a modified combined unipolar/bipolar sensing logic comprising:

detecting R-waves on the ventricular channel;

detecting candidate P-waves on the atrial channel;

determining whether the candidate P-waves occur within a first period of time bracketing detected R-waves; and

if not, concluding the candidate P-waves are true P-waves; and

if so, increasing a sensitive on the ventricular channel to equal a sensitivity on the atrial channel during the period of time bracketing the R-waves and determining R-waves are detected on the ventricular channel within a second, shorter, period of time bracketing the P-waves.

5. The method of claim 4 further comprising:

concluding that the candidate P-waves are true P-waves if R-waves are not detected on the ventricular channel within the second, shorter, period of time bracketing the P-waves; and

concluding that the candidate P-waves are false P-waves otherwise.

6. The method of claim 5 wherein the first period of time bracketing detected R-waves is about 400 milliseconds (ms) and the second period of time bracketing the P-waves is about 50 ms.

7. The method of claim 1 further comprising opening relative refractory windows within the atrial and ventricular refractory periods and wherein the step of determining the atrial rate using combined unipolar/bipolar sensing within the refractory periods only applies to events within the relative refractory windows of the refractory periods.

8. The method of claim 7 wherein tracking atrial and ventricular relative refractory windows within the atrial and ventricular signals comprises:

detecting an R-wave on the ventricular channel;

initiating atrial and ventricular blanking intervals on the atrial and ventricular channels, respectively, following detection of the R-wave for a predetermined blanking period of time; and

initiating atrial and ventricular relative refractory windows on the atrial and ventricular channels, respectively, immediately following completion of the atrial and ventricular blanking intervals for a predetermined relative refractory duration of time.

9. The method of claim 8:

wherein the ventricular blanking interval has a duration shorter than an average R-T interval occurring during normal sinus rhythm; and

wherein the ventricular blanking interval and the relative refractory window together have a combined duration longer than the average R-T interval of normal sinus rhythm such that the T-wave typically occurs during the ventricular relative refractory window.

10. The method of claim 8 wherein the atrial blanking interval has a duration equal to the ventricular blanking interval and the atrial relative refractory window has a duration equal to the ventricular relative refractory window such that the T-wave typically occurs during the atrial relative refractory window.

11. The method of claim 1 further comprising comparing the updated atrial rate against atrial tachycardia detection threshold (ATDR) threshold and performing a mode switch if automatic mode switching (AMS) is enabled and if the rate crosses the ATDR threshold.

12. The method of claim 1 further comprising comparing the updated atrial rate against atrial tachycardia detection threshold (ATDR) threshold and initiating an atrial high rate diagnosis procedure if automatic mode switching (AMS) is not enabled and if the rate exceeds the ATDR threshold.

13. The method of claim 1 further comprising comparing the updated atrial rate against atrial tachycardia detection threshold (ATDR) threshold and continuing to asses the atrial rate using combined unipolar/bipolar sensing so long as the rate does not exceed the ATDR threshold.

14. In an implantable cardiac stimulation device having an atrial bipolar lead and at least one ventricular lead, a system comprising:

an atrial sense amplifier operative to sense atrial channel signals;

a ventricular sense amplifier operative to sense ventricular channel signals;

a control unit operative to track refractory periods within atrial and ventricular channel signals; and

an atrial rate determination unit operative to determine an atrial rate using bipolar sensing outside the refractory periods and using combined unipolar/bipolar sensing within the refractory periods.

15. In an implantable cardiac stimulation device having an atrial bipolar lead and at least one ventricular lead, a system comprising:

means for tracking refractory periods within both the atrial and ventricular channel signals; and

means for determining an atrial rate using bipolar sensing outside the refractory periods and using combined unipolar/bipolar sensing within the refractory periods.